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GUIDE BOOK

Fourth Annual

Indiana Geologic Field Conference

Stratigraphy along the

Mississippian-Pennsylvanian Unconformity

of Western Indiana

1950

GUIDE BOOK

Fourth Annual Indiana Geologic Field Conference

May 12, 13, and 14, 1950

on

STRATIGRAPHY ALONG THE MISSISSIPPIAN-PENNSYLVANIAN UNCONFORMITY
OF WESTERN INDIANA

Conference Leader
Ralph E. Esarey

Sponsored by

Department of Geology, Indiana University, and
Division of Geology, Indiana Department of Conservation,
Charles F. Deiss, Chairman and State Geologist.

Compiled by
R. E. Esarey, D. F. Bieberman,
and R. A. Bieberman, Indiana University

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This guide book is respectfully dedicated to
Dr. Clyde A. Malott, a friend and inspiring teacher
who has devoted most of his professional career to
Indiana geology and has enjoyed teaching it to others.

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INTRODUCTION

The Mississippian-Pennsylvanian unconformity is the most pronounced and extensive break in the Paleozoic rocks of the Eastern Interior Basin. During the long erosional interval Mississippian beds were truncated and a topographic surface of considerable relief was developed. Pennsylvanian sediments rest on Upper Chester beds in southwestern Indiana, on Meremacian limestones in midwestern Indiana and on Osagian and upper Devonian beds in northwestern Indiana. Outcrops selected for the 1950 Field Conference show the Mississippian-Pennsylvanian unconformity and the stratigraphy along the unconformity in midwestern Indiana. Basal Pennsylvanian beds will be seen resting on Lower Chester, Ste. Genevieve, St. Louis, Salem, Harrodsburg, and Borden rocks representing a truncation of approximately 260 feet of sediments.

The conference has been planned to provide group observation of a portion of the Mississippian-Pennsylvanian unconformity and to promote group discussion of the problems associated with the unconformity. Mississippian stratigraphy will be emphasized, and special attention will be given to the old Mississippian topography and to the lithology of the basal Pennsylvanian beds. We hope that discussion combined with actual field observation will be of mutual benefit.

PROGRAM

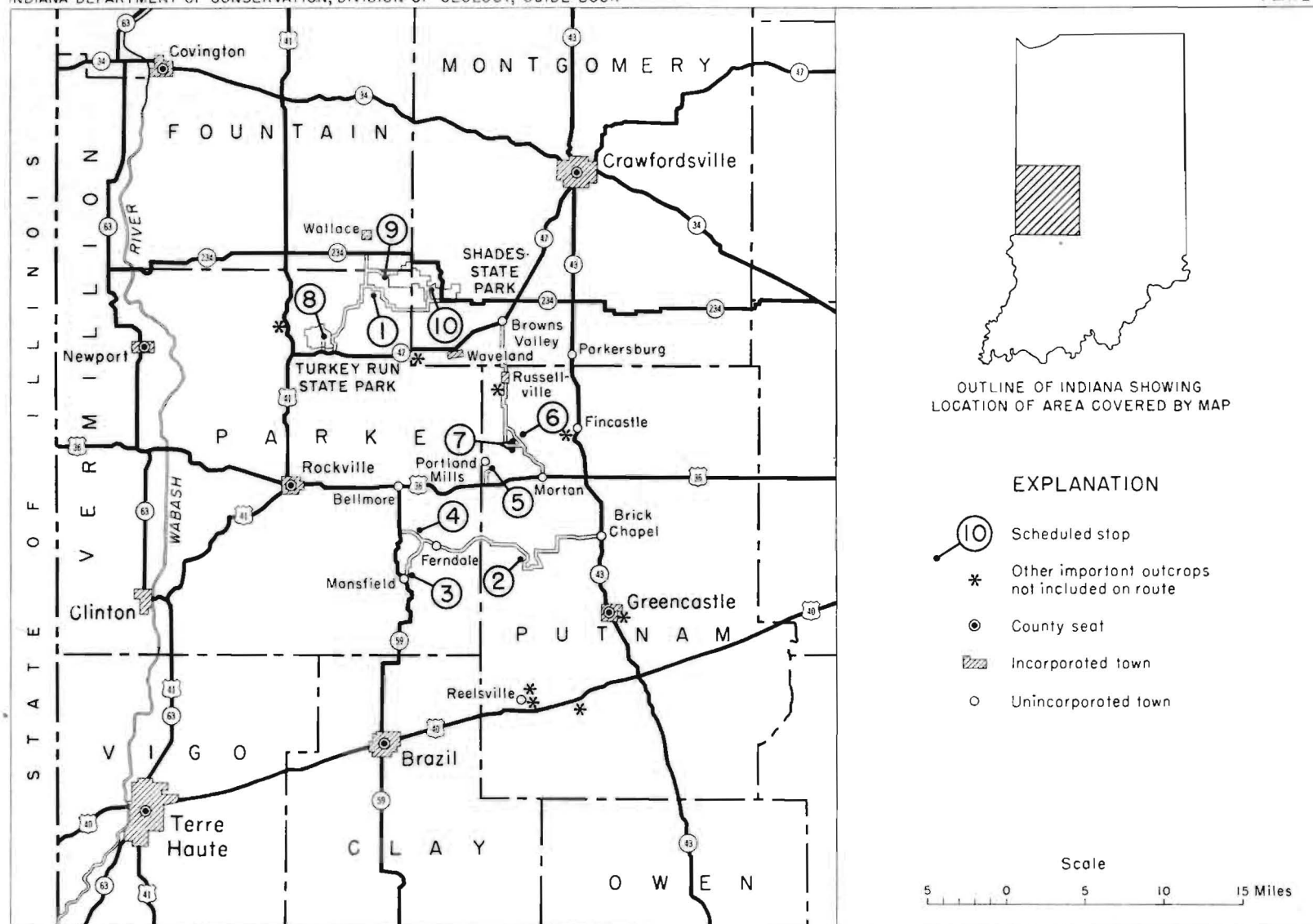
Headquarters for the conference is Turkey Run Inn, Turkey Run State Park, Marshall, Indiana.

The conference opens Friday evening, 7:30 (Central Standard Time), May 12, with discussions of the stratigraphy along the Mississippian-Pennsylvanian unconformity. Short talks will be given by Mr. R. A. Bieberman, Indiana University; Mr. Raymond Siever, Coal Section, Illinois Geological Survey; and Mr. C. E. Wier, Coal Section, Indiana Division of Geology. After the talks, Mr. R. E. Esarey, Conference Leader, will conduct an informal discussion in which you are invited to participate.

Saturday morning, May 13, at 8:00, the party leaves Turkey Run State Park for the first stop on the itinerary. A picnic lunch will be provided at the Mansfield Quarry by Turkey Run Inn for guests. Members of the conference staying elsewhere are urged to carry a lunch, as no lunch facilities are available. The caravan disbands at Stop #7, the last stop of the day. No formal program is planned for Saturday evening.

Sunday morning, May 14, at 8:00, the group will leave the Inn lobby for a tour of the park. The caravan will assemble at 9:00 o'clock and proceed to Stop #9. The conference ends at noon at Shades State Park, Montgomery County, Indiana.

Guests of Turkey Run Inn should check out before leaving Sunday morning unless they plan to return to the Inn for Sunday dinner.



ROUTE MAP OF FIELD CONFERENCE ON
MISSISSIPPIAN-PENNSYLVANIAN UNCONFORMITY IN WESTERN INDIANA

April, 1950

ITINERARY AND STRATIGRAPHIC SECTIONS

Saturday, May 13, 1950

Start: Leave Turkey Run State Park, Marshall, Indiana, at 8:00 A. M. (Central Standard Time).

At the park entrance the caravan turns east (left) on Highway 47 and proceeds 0.9 mile to gravel road forming eastern boundary of park. Turn north (left) on gravel road and proceed 0.7 mile to covered bridge over Sugar Creek. Note exposures of Mansfield extending below creek level. Cross covered bridge and turn east (right) on gravel road following Sugar Creek.

Follow winding road north and east 4.5 miles to "T" road. Turn east (right) and proceed east 0.8 mile to point where road turns south. Proceed south 0.2 mile to point where road again turns east. The caravan continues south on lane to abandoned farm.

The caravan will park in the abandoned farm yard, and the party will walk southeast to head of ravine. Follow ravine on east side to waterfalls. This section is located in a ravine on the north side of Sugar Creek about a quarter of a mile southwest of the iron bridge.

Stop #1 Iron Bridge Section (Time allotted 1 hr. 45 mi.
NW $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 7, T. 17 N., R. 6 W., Parke County

This section is part of a Mississippian inlier and shows the Mansfield sandstone resting unconformably on the Harrodsburg limestone. A quarter of a mile upstream and three quarters of a mile downstream on Sugar Creek the Mansfield sandstone extends below water level. The section is as follows:

	Feet
Mansfield sandstone	60
(Mississippian-Pennsylvanian unconformity)	
Harrodsburg limestone	60
Borden shale	5

The lower part of the Mansfield is massive, coarse, friable sandstone containing small iron concretions. A 3 inch quartz and chert pebble conglomerate lies at the base of the sandstone immediately above a 2 inch gray clay seam which marks the unconformity. Geodes occur in the Harrodsburg about 35 feet beneath the unconformity. This section contains many typical Harrodsburg fossils.

ITINERARY AND STRATIGRAPHIC SECTIONS

The caravan returns to the gravel road and proceeds east (right) 1 mile to iron bridge crossing Sugar Creek. Note Mansfield extends below water level at this point which is only a quarter mile upstream from Stop 1. Continue on gravel road 2 miles to cross roads. Continue east (straight ahead) to "T" road. Turn north (left) and proceed 0.5 mile to next "T". Turn east (right) onto black-top road and proceed 0.8 mile to point where black-top joins Highway 234.

The caravan will follow Highway 234 east 8.5 miles to Highway 43, and will proceed south on Highway 43 about 15 miles to small village of Brick Chapel. The quarry at the northern edge of Parkersburg (4 miles south of junction of Highways 234 and 43) is in the Harrodsburg limestone.

Many excellent outcrops can not be visited by the field conference because of time limitation, but sections important to a regional understanding of the Mississippian-Pennsylvanian unconformity are described in the itinerary in appropriate places. These additional sections are indicated on the route map (Pl. 1) and on the geologic map (Fig. 2) by asterisks.

Both northward and eastward truncation of Mississippian beds is beautifully illustrated by outcrops in Putnam County. The youngest Chester formation (Elwren sandstone) occurs near the small town of Reelsville in the southwestern corner of Putnam County. In the central western part of the county Pennsylvanian rests on the lower 8 feet of Chester rocks and on upper Ste. Genevieve limestone (Stop 2), while in the northern part of the county Pennsylvanian rocks lie on St. Louis, Salem, and Harrodsburg beds (Stops 5, 6, 7). Eastern truncation is shown by the Reelsville, Putnamville, and Greencastle sections which are described below.

Reelsville Sections

Putnam County

SW $\frac{1}{4}$ sec. 16, T. 13 N., R. 5 W.

About 3/4 mile north of Reelsville the eastern prong of the road descends into the valley of a small tributary to Walnut Creek. About 70 feet of Chester beds are exposed in the road cut and in the small ravine east of the road.

	Feet
Elwren, maroon and olive gray shale	21
Reelsville, coarse fossiliferous limestone	3
Sample, gray shale	17
Beaver Bend, granular to oolitic limestone	2.5
Mooretown, gray shale	7
Paoli, dense to oolitic white limestone	8
Aux Vases, upper 3 feet rubbly limestone, lower 9 feet massive calcareous sandstone	12

ITINERARY AND STRATIGRAPHIC SECTIONS

This section is of special interest because it shows the thickest Aux Vases sandstone outcrop known in Indiana. Notice the absence of sand in the Elwren and Sample formations. In the second Reelsville section just $3/4$ mile south these formations contain much sand. The Mansfield sandstone was not found in place at this section, but much float was found on the hillside.

NW $\frac{1}{4}$ sec. 21, T. 13 N., R. 5 W

The type section of the Reelsville limestone is located just south of Reelsville on the south bluff of Walnut Creek. About 75 feet of Lower Chester rocks are exposed along and below the highway roadcut.

	Feet
Elwren, thin bedded sandstone and sandy shale	23
Reelsville, granular to oolitic limestone weathering rust colored	2.7
Sample, gray shale and calcareous sandstone	16
Beaver Bend, granular to oolitic white limestone	11
Mooretown, gray shale (partly covered)	12
Paoli, white dense to oolitic limestone	11.5

Putnamville Quarries

SE $\frac{1}{4}$ sec. 18, T. 13 N., R. 4 W

Putnam County

The Putnamville State Farm lies on the south side of U. S. Highway 40 about $1\frac{1}{2}$ miles west of Putnamville. Two quarries are located on the farm, one active and the other abandoned. The active quarry is just south of U. S. Highway 40 and exposes about 90 feet of rock ranging from the Sample sandstone at the top to the St. Louis limestone at the bottom.

The abandoned quarry lies about $1/2$ mile southwest of the State Farm entrance. The uneven character of the Mississippian-Pennsylvanian contact is beautifully illustrated here.

	Feet
Mansfield, sandstone, shale, and coal	70
(Mississippian-Pennsylvanian Unconformity)	
Sample, gray shale	10
Beaver Bend, coarsely crystalline limestone	2
Mooretown, gray shale	5
Paoli, oolitic limestone	7
Aux Vases, calcareous sandstone and green sandy shale . .	6
Ste. Genevieve, brecciated limestone and white oolitic limestone	8

Pennsylvanian beds rest unconformably on the Sample, Beaver Bend, Mooretown, and Paoli formations in different parts of the quarry.

ITINERARY AND STRATIGRAPHIC SECTIONS

Greencastle Quarry

Putnam County

Center sec. 22, T. 14 N., R. 4 W

The large abandoned quarry located on the eastern edge of Greencastle shows the old highly eroded surface of the Ste. Genevieve limestone. Although as much as 40 feet of Ste. Genevieve limestone are exposed above water level in parts of the quarry rim, Pennsylvanian beds occur in deep channels, one of which extends beneath water level. When the quarry was operating, this channel could be seen extending into the top of the St. Louis limestone. The Pennsylvanian is composed mostly of dark shale, but pyritiferous sandstone containing plant impressions occurs near the bottom of the channels.

The caravan turns west (right) at Brick Chapel onto black-top road. Proceed west 2.7 miles and turn south (left) on gravel road. Continue south 1 mile to "T" road. Turn west (right) and proceed to bridge over Walnut Creek. Turn south (left) on west side of creek and proceed south 0.4 mile to black-top road. Continue south on black-top to point where black-top crosses Walnut Creek. Do not cross creek. Continue south on west side of creek on gravel road which soon turns west.

Old quarry north (right) of road (center sec. 3, T. 14 N., R. 5 W.) contains 20 feet of Ste. Genevieve limestone, 1 foot of calcareous Aux Vases sandstone, and 7 feet of Paoli limestone. Chunks of Mansfield sandstone occur in soil above.

The caravan continues west past old quarry to point where road jogs south for 100 yards and meets "T" road. Turn west at "T" and proceed 0.4 mile to narrow gravel road from the north, just east of small concrete bridge over creek. Turn north (right) on gravel road. Note Mansfield sandstone extends below drainage level at this point. Proceed north 0.8 mile to second stop.

Stop #2 Leatherman Branch Section (Time allotted 45 min.)
NE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 4, T. 14 N., R. 5 W., Putnam County

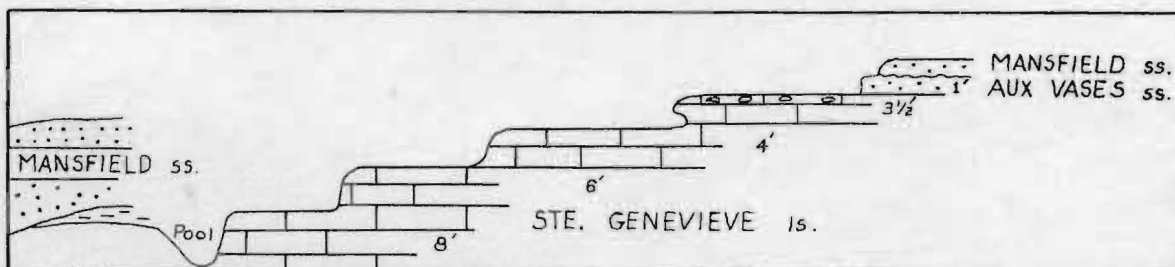


Figure 1. Leatherman Branch Section.

ITINERARY AND STRATIGRAPHIC SECTIONS

This outcrop is exposed in the bed of Leatherman branch (north prong) just west of the narrow gravel road. About $21\frac{1}{2}$ feet of upper Ste. Genevieve limestone are exposed in 4 waterfalls. The fourth waterfall upstream (see Fig. 1) is composed of cherty brecciated limestone characteristic of the top of the Ste. Genevieve section. The Aux Vases is represented by a bed of calcareous sandstone containing lime pellets. Mansfield sandstone immediately overlies the Aux Vases at this point. In the next meander bank upstream only Pennsylvanian rocks are exposed, but the Aux Vases again crops out in the creek bed and the oolitic Paoli limestone can be seen in the last bedrock exposure upstream.

Notice the bank of Mansfield sandstone below the plunge pool of the first waterfall. This outcrop section illustrates the uneven character of the old eroded Mississippian surface.

The caravan continues north on narrow gravel road about 0.5 mile to "T" road. Turn northwest (left) on gravel road and drive 1.3 miles to first road to the west. Turn west (left) on road and proceed 1.4 miles to end of road. Turn north (right) and proceed 1 mile to "Y" road. Keep to the left and proceed 2.5 miles to next "Y".

This short stretch of road crosses and re-crosses Rocky Fork Creek, and exposures of Pennsylvanian sandstone, shale, and coal may be seen in the valley walls. Since Stop 2 the caravan has been traveling west through the Pennsylvanian outcrop area. (See Fig. 2.)

At "Y" turn northwest (right) and proceed to the small village of Ferndale. Continue west through Ferndale and notice Mansfield extending below water level at bridge on west edge of town. Continue west 0.3 mile to bridge across Big Raccoon Creek. Both Pennsylvanian sandstone and Mississippian limestone can be seen along this stretch for the caravan is now crossing the southern end of a Mississippian inlier. (See Fig. 2.)

Cross bridge and proceed west along creek 0.5 mile to "Y". Turn right and proceed west 1.5 miles to Highway 59. Turn south (left) on Highway 59 and proceed to the old mill at Mansfield. Turn north at the old mill and proceed on gravel road 0.3 mile to Stop 3.

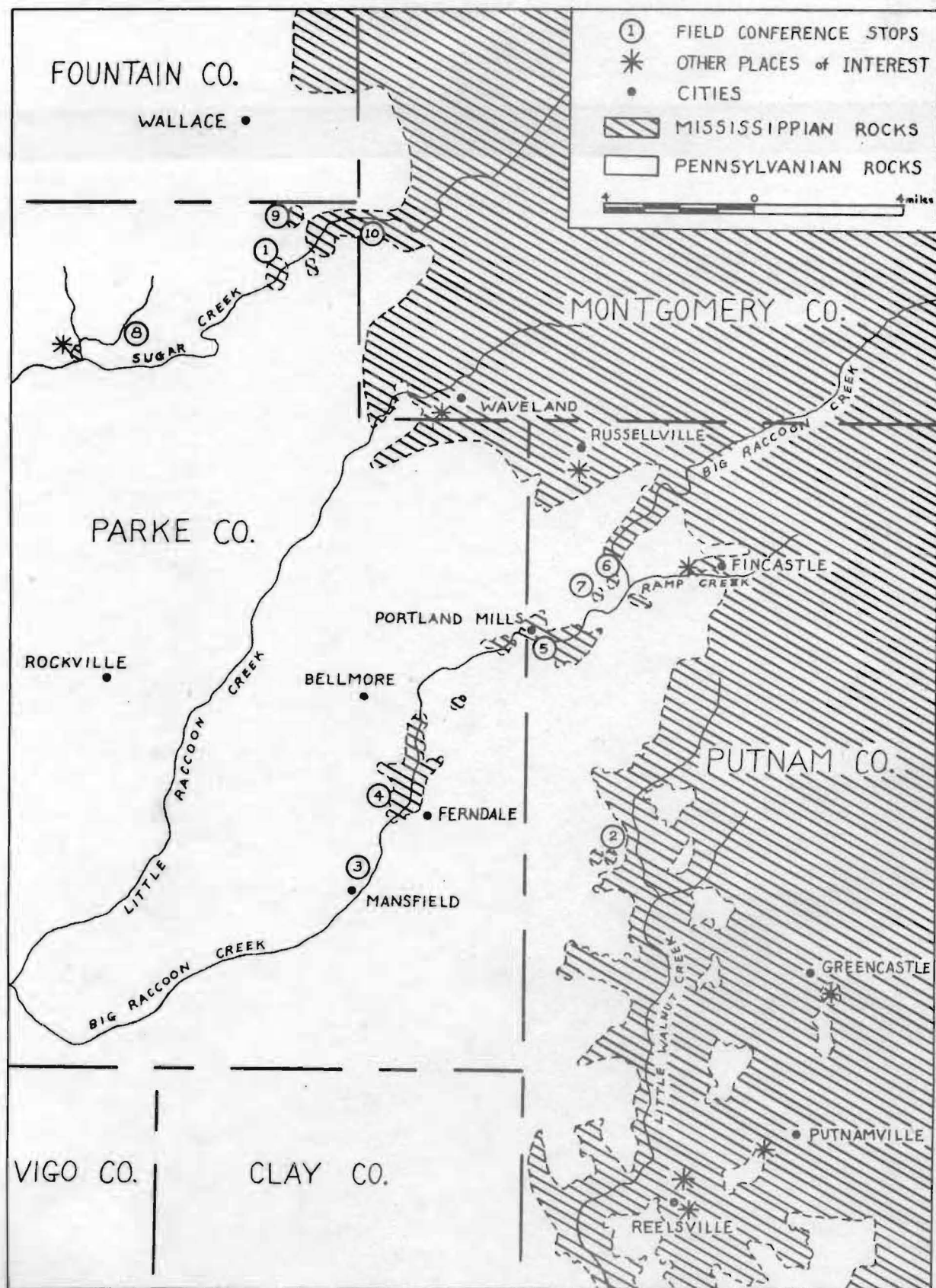


Figure 2. Geologic map of area covered by field conference. After Geologic map of Indiana, 1932.

ITINERARY AND STRATIGRAPHIC SECTIONS

Stop #3 Mansfield Quarry, Lunch Stop (Time allotted 1 hour)
 SE $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 5, T. 14 N., R. 6 W., Parke County

The Mansfield quarry, type section for the Mansfield sandstone, was opened in 1887 and, according to Hopkins (1896), produced more brownstone than any other one quarry in the state. A branch railroad was built to Brazil and stone was shipped to Evansville, Terre Haute, Fort Wayne, and Indianapolis, Indiana; Owensburg, Kentucky; Paynesville, Ohio; Chicago and Roseville, Illinois; and Wymar, Nebraska. Although the massive sandstone made good building material, the large number of iron concretions and patches of shale and shaly sandstone necessitated the handling of much waste material, and when the quarry was abandoned in 1894 more worthless stone than good stone remained.

The quarry face is about 35 feet high. Hopkins reports that a bore hole 200 yards east of the quarry showed 33 feet of brownstone underlain by 50 feet of lighter yellow colored sandstone. Notice the layer of chert conglomerate 4 to 5 feet thick at the top of the quarry. Conglomerate beds generally occur at or near the Mississippian-Pennsylvanian unconformity.

The caravan continues north on gravel road about 3 miles to "T" road. Many exposures of Mansfield can be seen along this stretch. Note the picturesque natural bridge of Mansfield sandstone on the west (left) side of the road 2 miles north of Stop 3. At the "T" road the caravan is again entering the Ferndale inlier, this time from the south. (See Fig. 2.) Turn west (left) at the "T" road and proceed 0.5 mile to Stop 4.

Stop #4 Berry Creek Section (Time allotted 1/2 hour)
 SE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 29, T. 15 N., R. 6 W., Parke County

In the Ferndale inlier the Mansfield rests unconformably on both the Ste. Genevieve and St. Louis limestones. This outcrop forms a small waterfall in the creek running just east of the gravel road on the Berry farm. Here 6 $\frac{1}{2}$ feet of basal Mansfield conglomerate rests unconformably on 5 $\frac{1}{2}$ feet of lower Ste. Genevieve limestone. The Ste. Genevieve is easily identified by the index fossil Platycrinus penicillus. Note the occurrence of the St. Louis index fossil Lithostrotion proliferum in the chert conglomerate.

ITINERARY AND STRATIGRAPHIC SECTIONS

The caravan continues west on gravel road 1 mile to Highway 59. Turn north (right) on Highway 59 and proceed to junction of Highway 59 and U. S. Highway 36 at Bellmore. Turn east (right) on U. S. Highway 36 and proceed east 3.3 miles.

At this point ($SW\frac{1}{4}$ sec. 11, T. 15 N., R. 6 W.) a highway park extends along the highway to the north and a small creek cuts into the hill on the south. A small gully in the hillside shows a nice section of Pennsylvanian rock approximately 50 feet thick, resting on 11 feet of St. Louis limestone. This is a small Mississippian inlier northwest of the Ferndale inlier. (See Fig. 2.)

The caravan continues east on U. S. Highway 36 to the Parke County line and proceeds into Putnam County 0.2 mile to gravel road. Turn north (left) on gravel road and proceed north 1 mile to point where the road is joined by gravel road from the east. Turn east (left) on road and proceed 0.5 mile to Stop 5.

Stop #5 Portland Mills Section (Time allotted 1/2 hour)
 $SW\frac{1}{4}NE\frac{1}{4}$ sec. 6, T. 15 N., R. 5 W., Putnam County

This section is located in a steep ravine just north of the narrow gravel road. About 28 feet of typical upper St. Louis limestone are exposed in the ravine, and an additional 32 feet of St. Louis are exposed in the bed of the small creek which flows from the ravine through a small valley to Big Raccoon Creek. The ravine section is as follows.

	Feet
Limestone, contains abundant chert balls and some fossiliferous layers of chert	11
Limestone, <i>Lithostrotion proliferum</i> on bedding planes . .	7.5
Dolomite, siliceous, weathers yellow	9

Mansfield float can be seen at the head of the ravine, but no Mansfield was found in place at this point. Mansfield sandstone does crop out, however, up the small valley which the ravine joins. There the Mansfield lies unconformably on the Lithostrotion proliferum zone.

The caravan will return to U. S. Highway 36 and proceed east (left) 3.8 miles to the small town of Morton. Turn north (left) onto black-top road at Morton. Proceed on black-top to covered bridge across Ramp Creek. Notice Mansfield sandstone extending below water level on south side of creek. Continue along black-top 0.7 mile to old quarry east (right) of road, Stop 6.

ITINERARY AND STRATIGRAPHIC SECTIONS

Stop #6 Grimes Quarry (Time allotted 1/2 hour)
Center $5\frac{1}{4}$ sec. 28, T. 16 N., R. 5 W., Putnam County

This quarry shows the farthest north typical Salem outcrop in Indiana. Eleven feet of Salem limestone are exposed in the top of the quarry, resting on 26 feet of Harrodsburg limestone. The contact between the two formations is marked by the top of a green siliceous dolomite bed 8 to 12 inches thick. This dolomite bed occurs about 15 feet above the quarry floor and is the top bed of the Harrodsburg.

Most of the Harrodsburg in this section is coarsely crystalline, fossiliferous limestone, chiefly composed of crinoid and bryozoan remains. Some of the beds exposed in the creek below the quarry floor are green siliceous dolomite similar to that marking the contact. The Salem limestone is harder than normal but contains an abundance of Endothyra baileyi.

This outcrop is a small Mississippian inlier. Two other inliers occur nearby. (See Fig. 2.) One of these is a quarter of a mile southwest and will be seen at Stop 7. The other lies about three quarters of a mile south-east on a tributary to Big Raccoon Creek. Salem and Harrodsburg are present in all three inliers and St. Louis in two. The maximum thickness of the Salem in this area is 20 feet and the lithology is extremely variable.

Fincastle Section Putnam County
 $NE\frac{1}{4}NW\frac{1}{4}$ sec. 25, T. 16 N., R. 5 W.

The Fincastle section is located on Ramp Creek about a mile west of Fincastle and 3 miles northeast of Grimes Quarry. About 100 yards east of the concrete bridge, a spectacular cliff 80 feet high rises on the north side of Ramp Creek. The section is as follows:

	Feet
Mansfield sandstone	40 - 20
(Mississippian-Pennsylvanian unconformity)	
Harrodsburg limestone	30 - 45
Borden shale	6

The irregularity of the unconformity is particularly striking in this outcrop. Coarse conglomerate about 13 feet thick occurs in the lower part of the Mansfield. The conglomerate is composed chiefly of chert pebbles, but also contains quartz pebbles and geodes.

The caravan continues north on black-top road about 1 mile to a crooked intersection. Turn south (left) on gravel road and proceed 1.2 miles to cross roads. Turn east (left) onto gravel road and proceed 0.6 mile to Stop 7.

ITINERARY AND STRATIGRAPHIC SECTIONS

Stop #7 Grimes Section (Time allotted 1/2 hour)
 Center SL sec. 28
 Center NL sec. 33 T. 16 N., R. 5 W., Putnam County

About 70 feet of rock are exposed in the bed of the small hillside creek which flows underneath the concrete bridge of the section line road. North of the road about 8 feet of lithographic St. Louis limestone can be seen near the top of the hill. A micro-oolitic, somewhat cross-bedded limestone (about 20 feet thick) lies beneath the St. Louis and extends down to the base of the concrete bridge. This rock is assigned to the Salem, although it is strikingly different from the Salem in Grimes Quarry which is only a quarter of a mile northeast. No Endothyra have been found in this rock, but in another inlier three quarters of a mile southeast Endothyra have been found in rock of similar lithology. Notice the ripple-marked limestone near the Salem-St. Louis contact.

The concrete bridge is built on an iron-red siliceous dolomite bed which is here considered the top of the Harrodsburg. Unfortunately, about 11 feet of the section are covered just south of the bridge. The first bed-rock exposed in the creek below the bridge is coarsely crystalline limestone composed chiefly of crinoid and bryozoan remains. A little farther down, the creek is running on Mansfield sandstone, and huge boulders of Mansfield crop out on the valley wall at this point. This is an old east-west channel filled with Pennsylvanian rocks. The Harrodsburg limestone reappears a short distance down stream. A total of 28 feet of Harrodsburg is exposed in the section.

This is the last stop of the day. Suggested route back to Turkey Run State Park follows. Continue east to black-top road. Turn north (left) on black-top and proceed 5 miles to Russellville.

Russellville Quarry Putnam County
 SW $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 8, T. 16 N., R. 5 W.

The Russellville Stone Company Quarry is located about a quarter of a mile south of Russellville on the west side of the black-top road. About 21 feet of St. Louis limestone are exposed in the quarry wall. The present quarry floor should be close to the top of the Salem, and this quarry may be of special stratigraphic importance if deepened.

Follow black-top north out of Russellville 4 miles to Browns Valley. Turn west (left) onto Highway 47 and proceed 3.5 miles to Waveland.

ITINERARY AND STRATIGRAPHIC SECTIONS

Waveland Quarry

Montgomery County

SW $\frac{1}{4}$ sec. 34, T. 17 N., R. 6 W.

The Waveland Stone Company Quarry, now abandoned, is located about 2 miles southwest of Waveland just north of the Pennsylvanian railroad tracks. About 52 feet of St. Louis limestone are exposed in the quarry face, and a text book example of an intraformational breccia occurs about 12 feet above the present water level. The breccia is 5 to 6 feet thick and is composed of large to small angular lithographic limestone fragments embedded in a matrix of argillaceous limestone. A massive bed of limestone near water level contains micro-oolites and strongly resembles the Salem lithology at the Grimes Section, Stop 7. The top of this bed is 2 feet above water level and may mark the top of the Salem limestone.

Continue west on Highway 47 through Waveland 8.5 miles to entrance of Turkey Run State Park.

Sunday, May 14, 1950

Start: The first section visited today (Stop 8) will be in Turkey Run State Park. The tour will leave promptly at 8:00 A. M. (Central Standard Time) from the lobby of Turkey Run Inn. The caravan will assemble at 9:00 o'clock to proceed to Stop 9.

Stop #8 Turkey Run State Park Section (Time allotted 1 hour)
Sec. 27, T. 17 N., R. 7 W., Parke County

Bold exposures of massive cross-bedded Mansfield sandstone occur along Sugar Creek gorge and bordering ravines in Turkey Run State Park. The route outlined below is designed to show as much of the rugged beauty of the park as possible in the time allotted.

The party will take the lower route of Trail 1 east from the Inn along the edge of Sugar Creek to Suspension Bridge. Cross Sugar Creek and follow Trail 4 up Rocky Hollow ravine to the Punch Bowl. Do not proceed farther than this point. Here the ravine ends and Trail 4 follows the uplands. The party will turn back at the Punch Bowl and follow Trail 3 (same route) back to Suspension Bridge. Cross bridge and follow upper route of Trail 1 back to the Inn.

The caravan turns west (right) at Turkey Run State Park entrance onto Highway 47 and proceeds 1.6 miles to junction of Highway 47 and U. S. Highway 41. Turn north (right) on U. S. Highway 41 and drive 0.9 mile to bridge crossing Sugar Creek just below Jungle Park.

ITINERARY AND STRATIGRAPHIC SECTIONS

Jungle Park Section

Parke County

SE $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 29, T. 17 N., R. 7 W.

Sugar Mill Creek empties into Sugar Creek about 100 yards west of U. S. Highway 41. On the east side of Sugar Mill Creek about 100 yards north of Sugar Creek, a small but interesting outcrop on the creek bank shows the Mansfield sandstone resting unconformably on the St. Louis limestone. The St. Louis beds are cherty, and chert is conspicuous in the basal Mansfield conglomerate. This outcrop is the farthest west Mississippian inlier in the Sugar Creek drainage area. About 6 miles northeast the Mansfield rests on the Harrodsburg limestone (Stop 1).

Continue north on U. S. Highway 41 to junction of U. S. Highway 41 and Highway 234. Turn east (right) on Highway 234 and proceed 5 miles to gravel cross road leading to Wallace. Turn south (right) on gravel road and proceed 1 mile to cross roads. Turn east (left) and proceed 1 mile to road going south marked by Wallace Stone Company sign. Turn south (right) and drive on winding road 0.9 mile to Wallace Stone Company Quarry.

Stop #9 Wallace Quarry

(Time allotted 1 hour)

NE $\frac{1}{4}$ sec. 7, T. 17 N., R. 6 W., Parke County

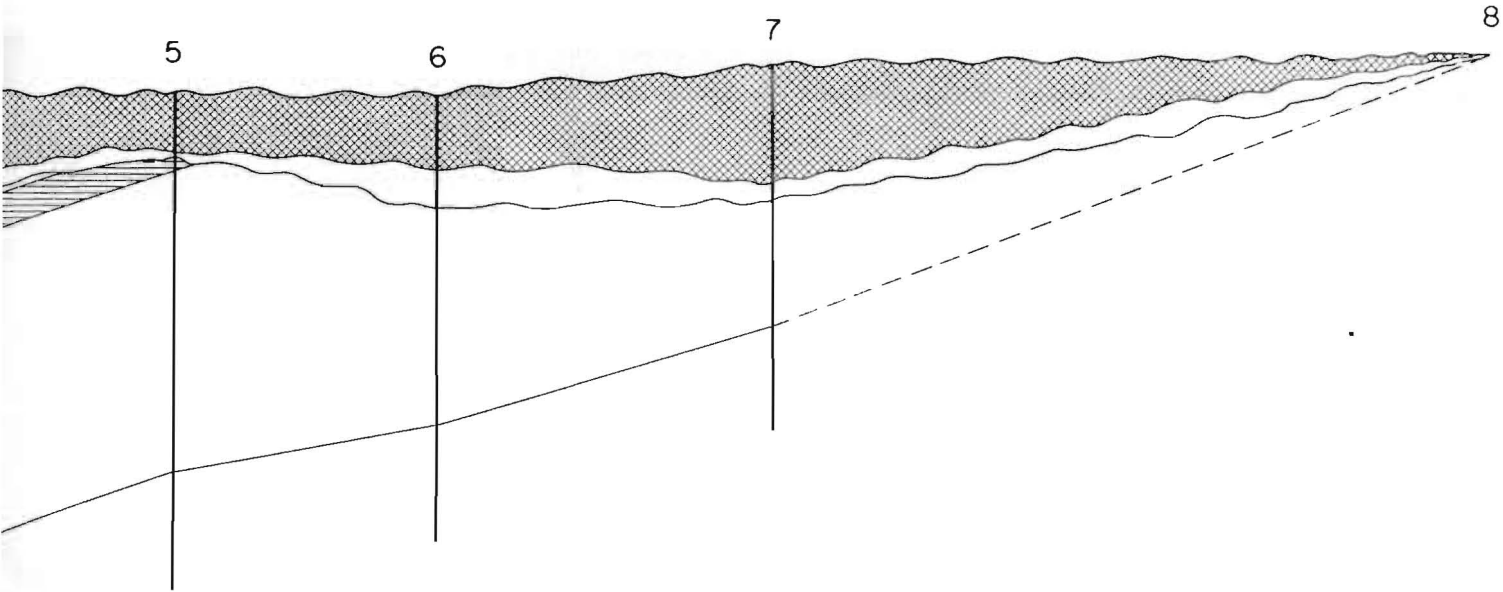
About 50 feet of Harrodsburg limestone are exposed in the Wallace Quarry, and Borden shale crops out in the valley southeast of the quarry. Unfortunately the Borden-Harrodsburg contact is covered by the spoil bank.

The Mississippian-Pennsylvanian contact occurs about 9 feet above the top of the quarry face in the road bank. The Mississippian rock beneath the contact is extremely weathered, and a 1 inch gray clay seam marks the contact. Chert rubble, about 9 inches thick, lies over the clay and is overlain by 2 feet of sandstone irregularly banded with large chert fragments.

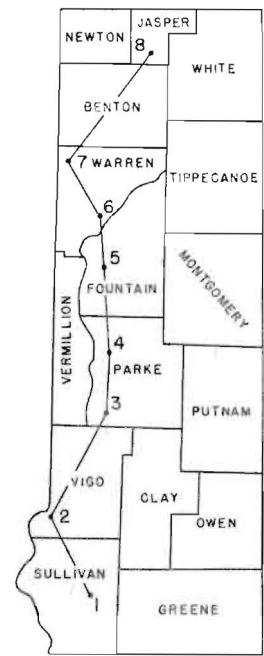
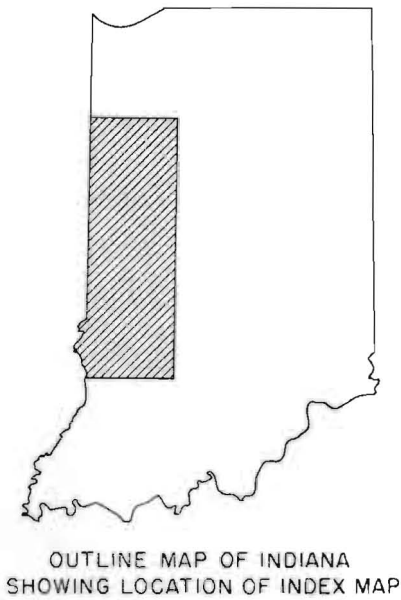
Notice the pocket of thin sand, shale, and coal layers in the Harrodsburg limestone about six feet below the top of the quarry. This pocket is 15 feet below the Mississippian-Pennsylvanian unconformity and probably represents Pennsylvanian fill in an old Mississippian sink hole.

The caravan will return to Highway 234 by the same route. Proceed up winding road to "T" road. Turn west (left) and drive 1 mile to cross roads. Turn north (right) and drive 1 mile to Highway 234.

Turn east (right) on Highway 234 and proceed 3 miles to point where Highway 234 turns south and enters Montgomery County. The caravan will follow the highway south 0.5 mile and east 1.3 miles to point where highway again turns south. Proceed along highway south to covered bridge. Winding road. Drive slow. Notice Borden bluffs. Cross covered bridge and continue south 1.5 miles on Highway 234 to point where highway turns east. Turn west onto black-top road leading into Shades State Park.

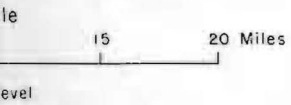


	Section	Township	Range
t kley	36	8N	9W
	36	11N	9W
	20	14N	8W
	16	16 N	8W
	16	19N	8W
	19	21N	8W
	24	23N	10W
	24	27N	7 W

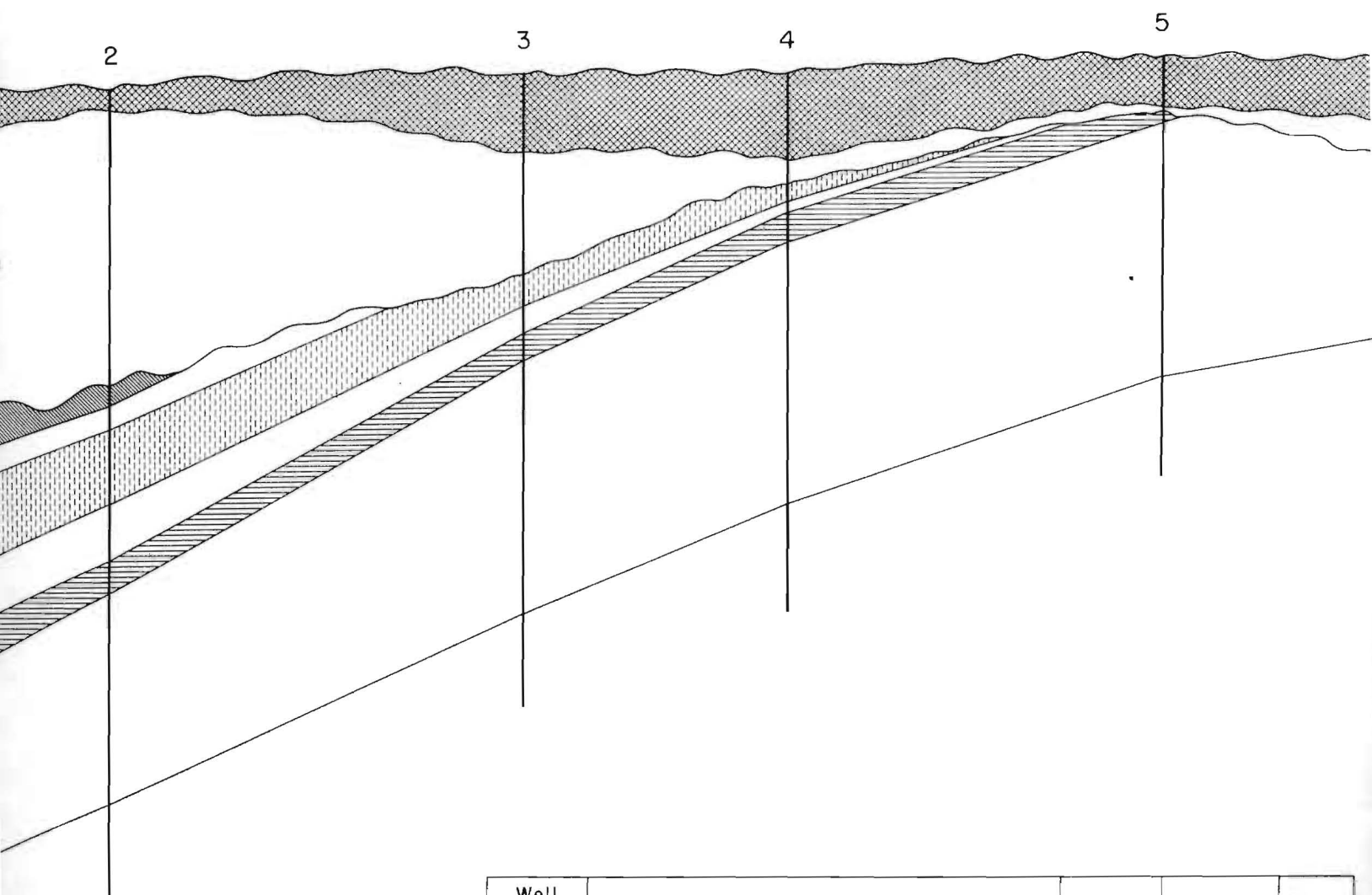


INDEX MAP SHOWING
LOCATION OF WELLS AND
OUTCROP IN COUNTIES

TRUNCATION OF MISSISSIPPIAN BEDS
ANIAN UNCONFORMITY



Compiled by R.A. Biebermon
April, 1950

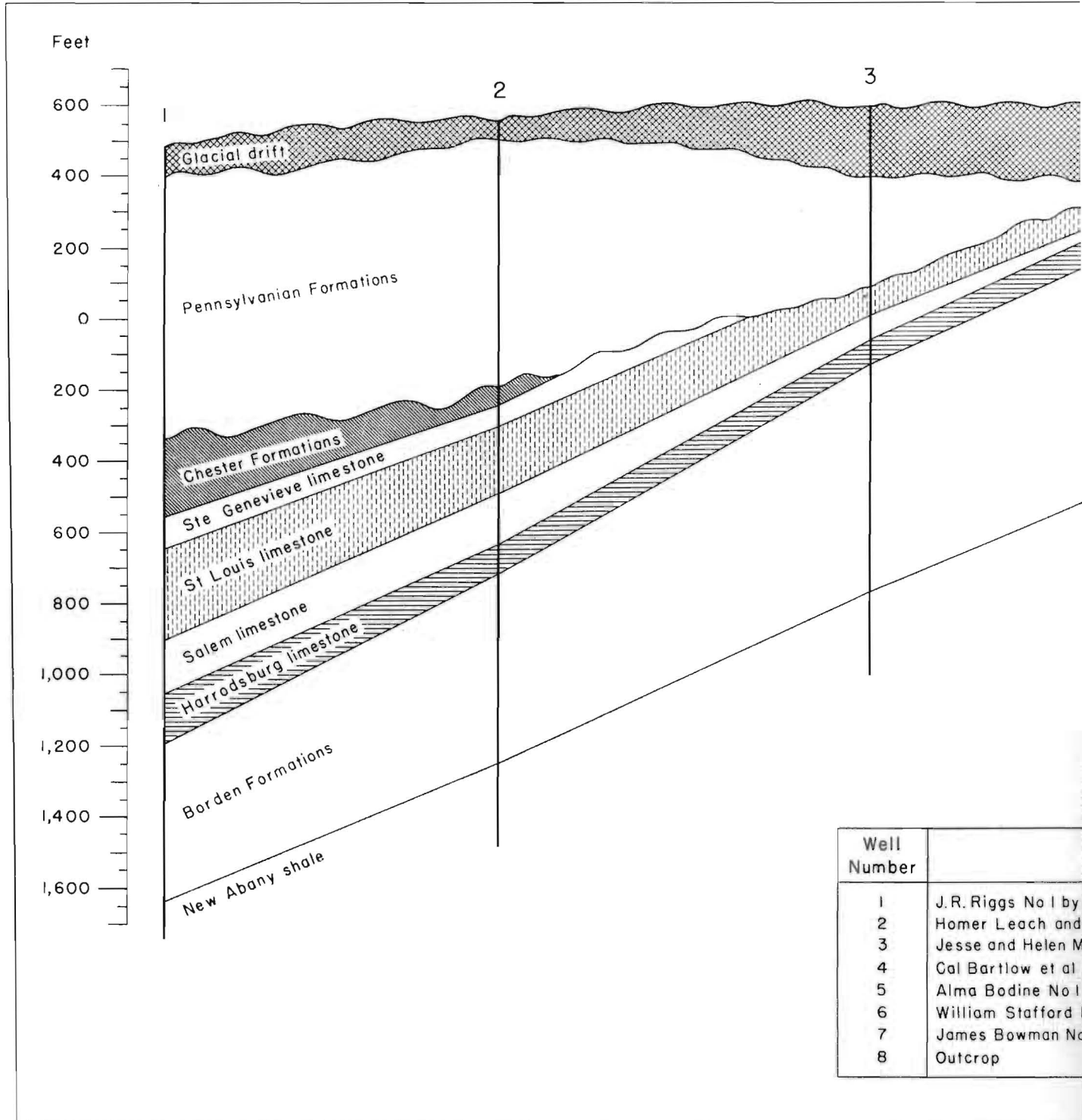


Well Number	NAME	Section	Township	Range
1	J.R. Riggs No.1 by Felmont Corporation	36	8N	9W
2	Homer Leach and wife No.1 by G.A. Earnhart	36	11N	9W
3	Jesse and Helen Montgomery No.1 by H.N. Oakley	20	14N	8W
4	Cal Bartlow et al No.1 by Clark C Nye	16	16N	8W
5	Alma Bodine No.1 by Aldridge and Banta	16	19N	8W
6	William Stafford No.1 by Warren Graves	19	21N	8W
7	James Bowman No.1 by Detrick and Topf	24	23N	10W
8	Outcrop	24	27N	7W

GENERALIZED CROSS SECTION SHOWING TRUNCATION OF MISSISSIPPIAN
AT MISSISSIPPIAN-PENNSYLVANIAN UNCONFORMITY



Datum is mean sea level



GENERALIZED CROSS SECTION
AT MISSISSIPPI

ITINERARY AND STRATIGRAPHIC SECTIONS

Stop #10 Shades State Park (Time allotted 1 hour)
 Sec. 11, T. 17 N., R. 6 W., Montgomery County

The Shades, recently acquired by the State of Indiana, has long been noted for its scenic attractions. The park, privately owned for over a hundred years, is located on the bluffs of Sugar Creek and contains 1,452 acres of virgin and semi-virgin timber. The spectacular cliffs of Mansfield sandstone and Borden silts along Sugar Creek make the park a fitting climax to the 1950 Field Conference.

The party will follow Trail 1 which crosses the concrete bridge over the Devil's Punch Bowl (a ravine 75 feet deep in the Mansfield sandstone). North of the bridge turn right and follow trail markers around the top of the bluff past Buzzard's Roost, View of Spread Eagle Cabin and Spring, and First View of Sugar Creek to Lookout Point, 210 feet above the creek. From here the massive Mansfield sandstone can be seen resting on the Borden silts. Follow arrows to ravine which descends to the Devil's Kitchen. From this point the trail follows the Mississippian-Pennsylvanian unconformity on the cliff face -- 55 feet of Mansfield above and 155 feet of Borden below. The trail leads to the spectacular Bridal Veil Falls where the party will disband. Follow the trail markers up the ravine past the Three Springs "Youth, Beauty, and Health" through the Devil's Punch Bowl to the parking lot.

This concludes the field conference.

Summary

In the area covered by the field conference eastward truncation of Mississippian strata is more strikingly illustrated than northward truncation. Eastward truncation is shown along Big Raccoon Creek where Pennsylvanian rocks lie on Ste. Genevieve limestone in the Ferndale inlier (Stop 4), on St. Louis limestone in the Portland Mills inlier (Stop 5), on Salem limestone in Grimes Quarry (Stop 6), and on Harrodsburg limestone in the Fincastle section, all within 12 miles. Beveling of Mississippian beds also is shown along Sugar Creek where Pennsylvanian rocks rest on St. Louis limestone at the Jungle Park section, on Harrodsburg limestone at the Iron Bridge section (Stop 1), and on Borden silts at the Shades State Park (Stop 10).

To the north truncation of Mississippian formations has been less severe and can be best demonstrated by subsurface data. Plate 2 shows a regional picture of the northern truncation of Mississippian beds at the Mississippian-Pennsylvanian unconformity. Outcrops in Putnam County showing northward truncation are discussed on page 8.

DESCRIPTIONS OF FORMATIONS

The following descriptions of formations are included to aid in identification. The descriptions are generalized and do not necessarily describe all outcrops. Thicknesses are taken from both outcrop and sub-surface data in Putnam County, Indiana. Only the important index fossils and abundant fossils are listed.

Devonian

New Albany shale: Upper Devonian (upper ten feet may be Mississippian). Type locality at New Albany, Floyd County, Indiana. Named by Borden, 1874. Dark brown to black, laminated, fissile, carbonaceous shale. Some portions soft greenish gray shale. Approximately 110 feet thick. Contains conodonts, sporangites, brachiopods, the pteropod Styliolina fissurella intermittens and fossil wood Callixylon newberryi.

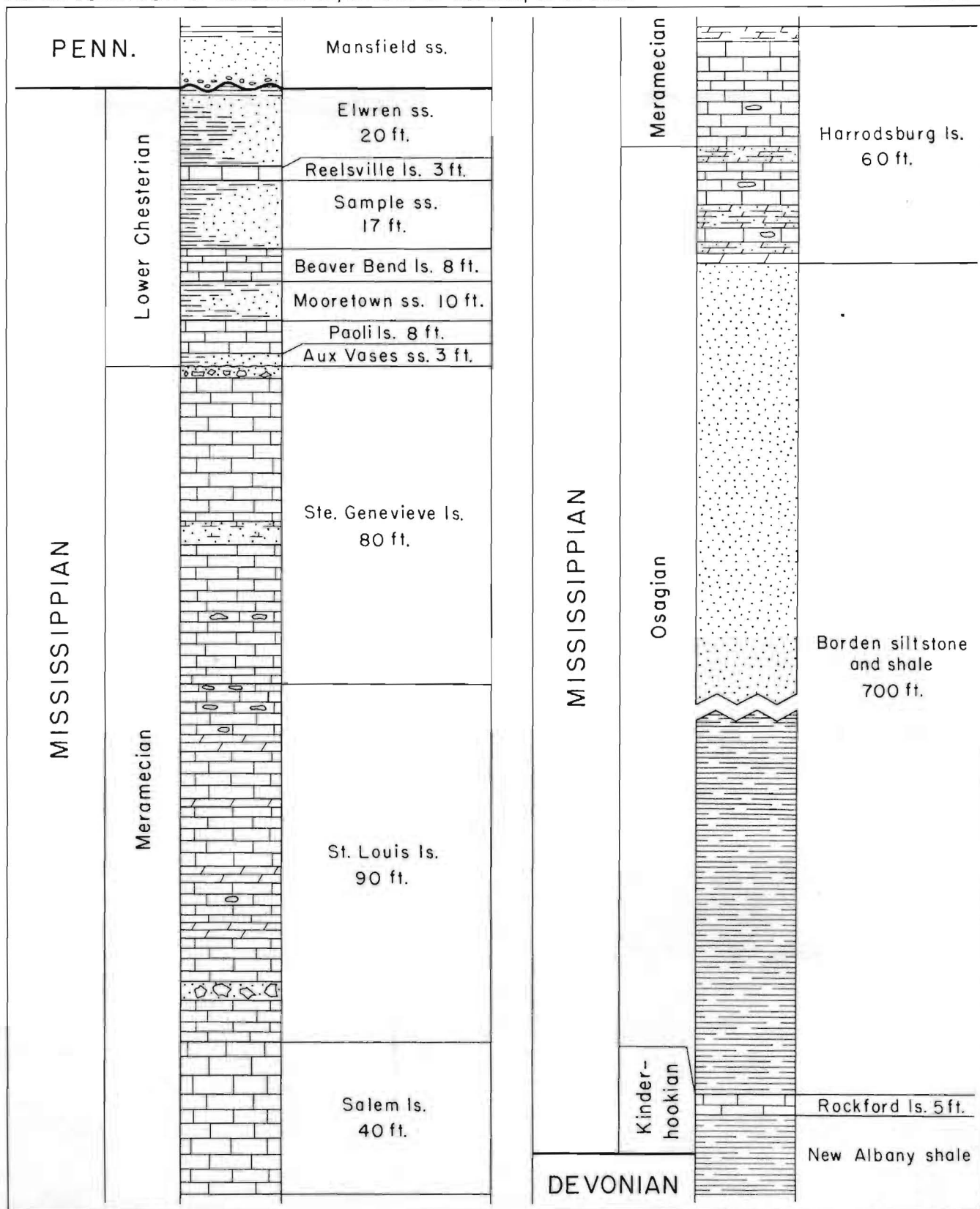
Lower Mississippian

Rockford limestone: Kinderhookian. Type locality at Rockford, Jackson County, Indiana. Named by Owen and Norwood, 1847. Gray to green mottled, hard, fine-grained limestone. Ranges in thickness from 1 to 10 feet. Well known for unusual goniatite fauna.

Borden group: Osagian. Type locality at Borden, Clark County, Indiana. Named by Cumings, 1922. Can be divided into two lithologic units in sub-surface. Upper unit, approximately 580 feet thick, greenish gray micaceous and glauconitic siltstone. Lower unit, approximately 120 feet thick, soft green shale named New Providence by Borden (1874). Stockdale (1931) divided Borden group into five formations retaining the name New Providence as basal formation and proposing Locust Point, Carwood, Floyd's Knob, and Edwardsville as formation names. Upper four divisions not recognizable in sub-surface. Index fossils, Orthotetes keokuk, Syringothyris texta.

Middle Mississippian

Harrodsburg limestone: Meramecian (lower beds Osagian). Type locality at Harrodsburg, Monroe County, Indiana. Named by Hopkins and Siebenthal, 1897. Limestone and dolomite with some shale partings especially in lower beds. Limestone coarsely crystalline, crinoidal. Dolomite fine-grained, siliceous. Upper 10 to 15 feet composed largely of bryozoan remains. Geodes and chert common in lower portion. Gradational contacts. Approximately 60 feet thick. Index fossils: Upper Harrodsburg, Rhipidomella dubia, Pentremites conoideus; Lower Harrodsburg, Schizophoria swallowi, Productus setigerus.



GENERALIZED STRATIGRAPHIC COLUMN OF
MISSISSIPPIAN FORMATIONS IN PUTNAM COUNTY, INDIANA

Compiled by C. A. Malott and
R. A. Bieberman. April, 1950

DESCRIPTIONS OF FORMATIONS

Salem limestone: Meramecian. Type locality at Salem, Washington County, Indiana. Named by Cumings, 1901. Massive, oolitic, fossiliferous limestone, brown to tan. Dolomitic, somewhat silty, "bastard" stone sometimes above, below, or interfingered with limestone. Ranges in thickness from 20 feet in northwestern Putnam County to 60 feet in southern part Putnam County. Abundance of foraminifera and small crinoid stems. Index fossil, Endothyra baileyi.

St. Louis limestone: Meramecian. Type locality at St. Louis, Missouri. Named by Engelman, 1847. Limestone and dolomite. Limestone granular to lithographic, tan to gray, thin-bedded, hard, compact. Dolomite fine-grained, gray, buff, and brown, siliceous. Occasional thin, blue-green, gray, and black shale layers. Abundant chert and black flint nodules in middle and upper part. Five foot limestone breccia 5 to 10 feet above base of formation in northern Putnam County. Approximately 90 feet thick. Index fossils, Lithostrotionella castelnaui (= Lithostrotion canadense), Lithostrotion proliferum.

Ste. Genevieve limestone: Meramecian. Type locality at Ste. Genevieve, Ste. Genevieve County, Missouri. Named by Shumard, 1860. Thick to thin bedded, crystalline, limestone, partially oolitic. Color white, buff, and light gray. Scattered chert. Divided into Fredonia, about 35 feet thick containing the Lost River chert zone; Rosiclare, about 6 feet thick composed of calcareous sandstone; Levias, about 35 feet thick topped by 2 to 5 feet brecciated limestone. Total thickness Ste. Genevieve about 80 feet. Index fossil, Platycrinus penicillus.

Upper Mississippian

Aux Vases sandstone: Lower Chesterian. Type locality along Aux Vases River, Ste. Genevieve County, Missouri. Named by Keys, 1892. Usually calcareous sandstone. Occasionally some green shale. Ranges in thickness from 1 to 12 feet.

Paoli limestone: Lower Chesterian. Type locality at Paoli, Orange County, Indiana. Named by Elrod, 1899. Compact, oolitic limestone, dark gray to nearly white. Sometimes broken by thin, calcareous, gray shale beds, usually fossiliferous. Ranges in thickness from 3 to 12 feet. Very fossiliferous in places. Index fossils, Spirifer leidei, Composita trinucula, and rare specimens of Talarocrinus.

Mooretown sandstone: Lower Chesterian. Type locality at Mooretown, Lawrence County, Indiana. Named by Cumings, 1922. Sandstone or shale or both. Sandstone fine to medium grained, cross-bedded. Shale soft, gray to blue. One or two thin coal beds or smut streaks common in shale. Ranges in thickness from 5 to 12 feet. Casts of Lepidodendron and Stigmara carbonica below coal seam in top of sandstone.

DESCRIPTIONS OF FORMATIONS

Beaver Bend limestone: Lower Chesterian. Type locality at big bend of Beaver Creek near Huron, Lawrence County, Indiana. Named by Malott, 1919. Highly oolitic limestone, white, often massive and conspicuously jointed. Base of limestone and top of Mooretown shale form important spring line. Ranges in thickness from 1 to 8 feet. Abundant Productus elegans and occasional Talarocrinus.

Sample sandstone: Lower Chesterian. Type locality at Sample station, Breckenridge County, Kentucky. Named by Butts, 1918. Sandstone and shale. Sandstone prominent in places. Shale and sandy shale in other places. Approximately 17 feet thick.

Reelsville limestone: Lower Chesterian. Type locality at Reelsville, Putnam County, Indiana. Named by Malott, 1919. Thin, compact, oolitic to sub-oolitic limestone containing considerable pyrite which causes a characteristic red color in weathered outcrop. Approximately 3 feet thick. Contains shark's teeth, Pentremites, and Talarocrinus.

Elwren sandstone: Lower Chesterian. Type locality at Elwren station, Monroe County, Indiana. Named by Malott, 1919. Sandstone, shale, and an occasionally thin siliceous limestone. Sandstone medium- to fine-grained and characteristically ripple-marked. Shale blue-gray to olive green with maroon streaks. Approximately 20 feet thick.

Pennsylvanian

Mansfield sandstone: Pottsvillian. Type locality at Mansfield, Parke County, Indiana. Named by Hopkins, 1896. Massive, coarse-grained, variegated sandstone sometimes containing thin-bedded shaly sandstone, black shale and coal. Often quartz and chert pebble conglomerate at base. Massive sandstone characterized by cross-bedding and iron concretions. Ranges in thickness from 10 to 100 feet. Contains plant remains.

BIBLIOGRAPHY

- Barrett, Edward (1917) The beautiful Shades, Indiana Dept. Geol. and Nat. Res., 41st Ann. Rept., 1916, pp. 80-87, 10 pls.
- Bieberman, R. A. (1950) The Mississippian-Pennsylvanian unconformity in middle western Indiana, Masters thesis in preparation, Indiana University.
- Cumings, E. R. (1922) The nomenclature and description of the geological formations of Indiana, Handbook of Indiana geology, Indiana Dept. Cons. Pub. 21, pt. 4, pp. 472-516, figs. 25-29.
- Gault, H. R. (1939) The heavy minerals of the Mansfield sandstone of Indiana, Indiana Acad. Sci. Proc., 1938, vol. 48, pp. 129-136, 2 figs.
- Hopkins, T. C. (1896) The Carboniferous sandstones of western Indiana, Indiana Dept. Geol. and Nat. Res., 20th Ann. Rept., 1895, pp. 186-327, 9 pls., 7 figs., 2 maps.
- Hopkins, T. C. and Foerste, A. F. (1904) A short description of the topography of Indiana and of the rocks of the different geological periods, Indiana Dept. Geol. and Nat. Res., 28th Ann. Rept., 1903, pp. 15-77.
- Malott, C. A., Stratigraphy of Ste. Genevieve and Chester formations of southern Indiana, unpublished manuscript.
- Malott, C. A., Esarey, R. E. and Bieberman, D. F. (1948) Upper and Middle Mississippian formations of southern Indiana, Indiana Univ. Dept. Geol. and Indiana Dept. Cons., Guide Book, 2nd Ann. Indiana Geol. Field Conf., 26 pp., 2 pls., 8 figs.
- Patton, J. B. (1949) Crushed stone in Indiana, Report of Progress No. 3, Indiana Dept. Cons., 47 pp., 1 pl.
- Shrock, R. R. (1940) Weathering of ferruginous beds in the Pennsylvanian of Greene County, Indiana, Indiana Acad. Sci. Proc., 1939, vol. 49, pp. 163-168, 5 figs.
- Stockdale, P. B. (1931) The Borden (Knobstone) rocks of southern Indiana, Indiana Dept. Cons. Pub. 98, 330 pp., 72 figs., 7 pls.
- Weller, J. M. and Sutton, A. H. (1940) Mississippian border of Eastern Interior Basin, Am. Assoc. Petroleum Geologists Bull. vol. 24, pp. 765-858, 10 figs.